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Models of Spinodal Decomposition in an Oxide Diluted Magnetic Semiconductor, $Zn_{1-x}Co_xO$ MICHAEL WHITE, STEFAN OCHSENBEIN, TRACY LOVEJOY, MARJORIE OLMSTEAD, DANIEL GAMELIN, University of Washington — Magnetic-ion-rich nanoscale domains formed by spinodal decomposition have been postulated for many diluted magnetic semiconductors, and are implicated in some materials for the observed ferromagnetic ordering. Colloidal nanocrystals of the ternary alloy wurtzite $Zn_{1-x}Co_xO$, with x ranging from 0.0 (w-ZnO) to 1.0 (w-CoO), have been synthesized as model systems for the proposed spinodal decomposition of ferromagnetic $Zn_{1-x}Co_xO$ thin films and powders. These enriched phases do not show any signs of ferromagnetism for any value of x. Changes in the electronic absorption, magnetic circular dichroism, and X-ray photoelectron (XPS) spectra with x are defined that will allow identification of spinodal decomposition in other $Zn_{1-x}Co_xO$ samples. Optical, magneto-optical, and XPS results are presented for the end member of this series (w-CoO), for the first time, and show this binary oxide to be an indirect-gap charge-transfer insulator with $E_g \approx 2.3$ eV. Reduction of Co^{2+} to Co^0 by argon ion (Ar^+) sputtering was found to become markedly more facile with increasing x, placing spinodally segregated $Zn_{1-x}Co_xO$ at greater risk of yielding false-positive Co^0 XPS signals than dilute $Zn_{1-x}Co_xO$ with the same average composition. Reference: White, M.; Ochsenbein, S.; Gamelin, D., *Chem. Mater.*, **2008**, 20, 7107.

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